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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	TRELEWICZ et al.	Examiner:	Thompson, J.
Serial No.:	09/898,254	Group Art Unit:	2624
Filed:	July 3, 2001	Docket No.:	BLD920010008US1 (IBMN.026US01-0526)
Title:	METHOD AND APPARATUS FOR CONTROLLING A SPOT FUNCTION FOR DIGITAL HALFTONING		

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence and the papers, as described hereinabove, are being deposited in the United States Postal Service, as first class mail, in an envelope addressed to: Mail Stop Appeal, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on June 18, 2007.

By: David W. Lynch
David W. Lynch

APPEAL BRIEF

MAIL STOP APPEAL
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an Appeal Brief submitted pursuant to 37 C.F.R. § 41.37 for the above-referenced patent application. Please charge Deposit Account No. 50-3669 (**BLD920010008US1**) in the amount of $500.00 for this brief in support of appeal as indicated in 37 C.F.R. § 41.20(b)(2).

I. Real Party In Interest

The real party in interest is International Business Machines Corporation, having a place of business at New Orchard Road, Armonk, New York 10504. This application is assigned to International Business Machines Corporation.

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X. <u>Related Proceedings Appendix</u>

As stated in Section II above, Appellant is unaware of any related appeals, interferences or judicial proceedings.

II. Related Appeals And Interferences

Appellant is unaware of any related appeals, interferences or judicial proceedings.

III. Status Of Claims

Claims 1-2, 5, 7, 8, 11, 13, 14, 17-18, 21 and 23 are rejected. Claims 1-2, 5, 7, 8, 11, 13, 14, 17-18, 21 and 23 are presented for appeal and may be found in the attached Appendix of Appealed Claims in their present form.

IV. Status Of Amendments

Claims 18 and 21 were amended to correct informalities in the preamble of each claim. The Advisory Action indicated that the amendment of claims 18 and 21 would be entered upon the filing of an appeal. No further amendments to the claims were made subsequent to the final rejection of Appellants' application.

V. Summary Of Claimed Subject Matter

The claimed subject matter provides a method and apparatus for prioritizing print jobs from multiple printer input channels.

Independent claim 1 presents a method for generating a spot for use in halftoning. The method includes defining a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell (210,220, page 16, lines 9-16). The spot function is scaled according to grayscale levels using a parameterized spot radius scaling function (page 16, lines 20-23) that varies according to a value of a first and second spot function ordinate (x, y, page 16, lines 14-16) and an asymmetric shape changing scaling function based on a gray level for the spot (S(p,r), page 16, lines 20-23). The scaled spot function is used for printing (600, page 19, line 1). The spot function is described by:

$$f(x,y) = \frac{1}{2}\left(\cos(\pi x / p_x) + \frac{1}{S(p,r)}\cos(\pi y / p_y)\right) \quad \text{(page 16, line 23)}$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y (page 16, lines 18-19), p is a spot shape parameter for controlling the shape of the spot (page 16, line 19), S(p,r) is a scaling function (page 17, line 1), and r is the radius of the spot (page 17, lines 1).

Independent claim 7 presents a printing system. The printing system includes a control unit for receiving a print file and processing the print file for printing (640, page 19, lines 10-11), a print head for conveying a print job according to the print file (650, page 19, line 12) and a device for generating a spot for use in halftoning (604, page 19, lines 20-21; 660, page 19, line 21; 622, page 19, line 22; 640, page 19, lines 22-23) wherein the halftoning reproduces an image defined by the print file using the print head (650, page 19,

line 12), the device defines a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell and scales the spot function according to grayscale level using a parameterized spot radius scaling function (page 16, lines 20-23) that varies according to a value of a first and second spot function ordinate (x, y, page 16, lines 14-16) and an asymmetric shape changing scaling function based on a gray level for the spot (S(p,r), page 16, lines 20-23). The spot function used by the device is described by:

$$f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$$ (page 16, line 23)

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y (page 16, lines 18-19), p is a spot shape parameter for controlling the shape of the spot (page 16, line 19), S(p,r) is a scaling function (page 17, line 1), and r is the radius of the spot (page 17, lines 1).

Independent claim 17 presents a program storage medium (690, page 21, lines 3-5) readable by a computer, the medium tangibly embodying one or more programs of instructions (692, page 21, lines 6-7) executable by the computer to perform halftoning an image. The computer performs halftoning of an image by defining a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell, scaling the spot function according to grayscale level using a parameterized spot radius scaling function (page 16, lines 20-23) that varies according to a value of a first and second spot function ordinate (x, y, page 16, lines 14-16) and an asymmetric shape changing scaling function based on a gray level for the spot (S(p,r), page 16, lines 20-23) and printing using the scaled spot function (page 19, line 1). The spot function is described by:

$$f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right) \quad \text{(page 16, line 23)}$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y (page 16, lines 18-19), p is a spot shape parameter for controlling the shape of the spot (page 16, line 19), S(p,r) is a scaling function (page 17, line 1), and r is the radius of the spot (page 17, lines 1).

Independent claim 23 presents a printing system. The printing system includes means for receiving a print file and processing the print file for printing (640, page 19, lines 10-11), means for conveying a print job according to the print file (650, page 19, line 12) and means for generating a spot for use in halftoning (604, page 19, lines 20-21; 660, page 19, line 21; 622, page 19, line 22; 640, page 19, lines 22-23) wherein the halftoning reproduces an image defined by the print file using the print head (650, page 19, line 12), the means for generating a spot defines a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell and scales the spot function according to grayscale level using a parameterized spot radius scaling function (page 16, lines 20-23) that varies according to a value of a first and second spot function ordinate (x, y, page 16, lines 14-16) and an asymmetric shape changing scaling function based on a gray level for the spot (S(p,r), page 16, lines 20-23). The spot function is described by:

$$f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right) \quad \text{(page 16, line 23)}$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y (page 16, lines 18-19), p is a spot shape parameter for controlling the shape of the spot (page 16, line 19), S(p,r) is a scaling function (page 17, line 1), and r is the radius of the spot (page 17, lines 1).

Dependent claims 5, 11 and 21 further define the scaling function, S(p,r), as being described by:

$$S(p,r)=1+\frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{\left(r/\sqrt{2}-1/2\right)^2}{2p^2}\right)$$ (page 17, lines 1-3),

where p_m sets a maximum ellipticity of the spot (page 17, line 20).

VI. Grounds Of Rejections To Be Reviewed On Appeal

Appellant has attempted to comply with new rule 37 C.F.R. § 41.37(c) by providing the Office Action's grounds of rejection verbatim, followed by an argument section corresponding thereto.

A. In paragraph 6 on page 3 of the Office Action, claims 17, 18 and 21 were rejected under 35 U.S.C. § 101.

B. In paragraph 8 on page 4 of the Office Action, claims 1-2, 7-8, 17-18 and 23 were rejected under § 103(a) as being unpatentable over Curry in view of Allen.

C. In paragraph 9 on page 6 of the Office Action, claims 5, 11 and 21 were rejected under § 103(a) as being unpatentable over Curry and Allen in further view of obvious engineering design choices.

D. In paragraph 10 on page 7 of the Office Action, claim 13 was rejected under § 103(a) as being unpatentable over Curry and Allen in further view of Vaswani.

E. In paragraph 11 on page 7 of the Office Action, claim 14 was rejected under § 103(a) as being unpatentable over Curry and Allen in further view of Cunniff.

VII. Argument

A. REJECTION OF CLAIMS 17, 18 and 21 UNDER 35 U.S.C. § 101

1. INDEPENDENT CLAIM 17 MEETS THE REQUIREMENTS OF 35 U.S.C. § 101

Independent claim 17 presents a program storage medium readable by a computer, the medium tangibly embodying one or more programs of instructions executable by the computer to perform halftoning an image. The computer performs halftoning of an image by defining a spot function . . . and scaling the spot function . . . . The scaled spot function is used to print.

a. Claim 17 Does Not Fall Within The Three Judicial Exception Categories Of Non-Statutory Subject Matter

The Supreme Court has identified three judicial exception categories of non-statutory subject matter: 1) Laws of nature, per se; 2) Natural phenomena, per se; and 3) Abstract ideas, per se. Claim 17 is clearly not directed to a law of nature, natural phenomena or abstract ideas, per se. Rather, claim 17 recites a program storage medium readable by a computer, wherein the medium tangibly embodies one or more programs of instructions executable by the computer to perform halftoning of an image. The final Office Action stated that claim 17 recites software per se. The final Office Action also states that claim 17 does not recited a computer-readable medium encoded with a computer program which defines structural and functional interrelationships between the computer program and the rest of the computer that permits the computer programs functionality to be realized. Data structures not claimed as embodied in computer-readable media are descriptive material per se and are not statutory because they are not capable of causing functional change in the computer. Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention that permit the data structure's functionality to be realized.

In contrast, a claimed computer-readable medium encoded with a data structure defines structural and functional interrelationships between the data structure and the computer software and hardware components which permit the data structure's functionality to be realized, and is thus statutory. Moreover, Appellant respectfully submits that the instructions executable by the computer to perform halftoning an image are functionally descriptive. The functional

operations recited include defining a spot function, scaling the spot function and printing using the scaled spot function.

When functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994).

Accordingly, Appellant respectfully submits that claim 17 is statutory and therefore the rejection under 35 U.S.C. § 101 should be withdrawn.

b. Claim 17 Recites A Practical Application And Produces A Useful, Concrete And Tangible Result

Even if claim 17 fits one of the judicial exceptions, Appellant respectfully submits that claim 17 recites a practical application and produces a useful, concrete and tangible result.

i. Claim 17 Performs A Physical Transformation

A claim is directed to a practical application when there is a physical transformation. The process of printing using the scaled spot function is clearly a physical transformation. In operation, the computer takes image data and transforms it to print data using the scaled spot function. The image data is physically transformed to a different structural state, i.e., halftoned and printed according to the scaled spot function.

Accordingly, Appellant respectfully submits that claim 17 is statutory and therefore the rejection under 35 U.S.C. § 101 should be withdrawn.

ii. Produce A Useful, Concrete, and Tangible Result

Physical transformation is an indication that the claim is statutory because such a transformation itself is a useful, tangible and concrete result. Claim 17 is clearly useful because the halftoning using the scaled spot function and printing using the scaled spot function is a specific and substantial use. Moreover, the printing using the scaled spot function is not an abstract result, but rather is tangible results. For example, if paper is printed, the printout includes halftone images that are printed on the paper using the scaled spot function. Lastly, claim 17 recites a concrete result, i.e., printing using the scaled spot function. The printing can be substantially repeatable, assuming the image to be halftoned and printed using the scaled spot function is the same. A claim to a proper computer readable medium tangibly embodying functional descriptive material that can function with a computer to effect a useful, concrete and tangible result (e.g., printing using the scaled spot function) satisfies the practical application test.

Accordingly, Appellant respectfully submits that claim 17 is statutory and therefore the rejection under 35 U.S.C. § 101 should be withdrawn.

B. REJECTION OF CLAIMS 1-2, 7-8, 17-18 AND 23 UNDER 35 U.S.C. § 103(A) AS BEING UNPATENTABLE OVER CURRY IN VIEW OF ALLEN, VASWANI AND CUNNIFF

1. INDEPENDENT CLAIMS 1, 7, 17 AND 23 ARE PATENTABLE OVER CURRY, ALLEN AND

a. CURRY FAILS TO DISCLOSE, TEACH OR SUGGEST

Claim 1 recites defining a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell, scaling the spot function according to grayscale levels using a parameterized spot radius scaling function

that varies according to a value of a first and second spot function ordinate and an asymmetric shape changing scaling function based on a gray level for the spot and printing using the scaled spot function;

wherein the spot function is described by:

$$f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y, p is a spot shape parameter for controlling the shape of the spot, S(p,r) is a scaling function, and r is the radius of the spot. Claims 7, 17 and 23 recite similar limitations.

Curry does not suggest defining a spot function described by $f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$. In fact, an equation for an ellipse may take many different forms: $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$; $r^2=\frac{(b^2a^2)}{b^2\cos^2\Theta+a^2\cos^2\Theta}$, (x=a cos(t); y=b sin(t)).

Accordingly, the suggestions of using the equation $f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$ is provided by Appellant's own specification, not by Curry. Furthermore, the final Office Action uses impermissible hindsight to arrive at using $f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$ for the equation for an ellipse.

The final Office Action does not address the scaling of a spot function ordinate. More specifically, Curry does not suggest scaling a first spot function ordinate. Curry also does not suggest scaling a second spot function ordinate. Curry does not disclose a scaling function that is based on a spot shape parameter for controlling the shape of the spot and the radius of the spot.

Rather, Curry discloses a printing system for rendering halftoned image data on a recording medium that includes halftoning circuitry for receiving grayscale input image data and transforming the grayscale input image data into multi-bit value output data. The halftoning circuitry includes a look-up table for providing the output data defining halftone dots. The halftone dots are arranged in the look-up table as a continuum from a lowest density value to a highest density value. Addressing circuitry provides address lines defining a screen, wherein the address lines provide x and y address values defined by a desired screen angle. The addressing circuitry includes rotation circuitry for modifying the x and y address values thereby rotating the halftone dots. Shifting circuitry is provided for modifying the x and y address values thereby shifting the reference point of the halftone dots. The shifting and the rotating occur while the halftone dots are being read from the look-up table.

Curry further states that the halftoner converts resampled information into a binary map. A halftone cell 170 includes a halftone dot 172 using spot 182 with addressability within cell 170. The resolution of the spot is determined by the spot size 182. In order to render halftone dot 172, spots are placed as close as possible to the target edge of the halftone dot 172. As the value for the grayscale data changes, the radius (or other density determining parameter) of the halftone dot changes. The halftone screen provides is a regular rectangular array of dot positions covering the entire image. Data fetched at each memory location is one of the five values (0%, 25%, 50%, 75%, or 100%) to cause the laser spot to have the intensity required to render the halftone dot

According to Curry, the halftone generator 70 first obtains a value at each memory location that is a value meant to go directly to the D to A converter 76. This differs from

prior art where numbers accessed are generally compared with the input intensity value 197 by a binary comparator that outputs either a zero or one to drive a laser diode

Figs. 30-33 of Curry show halftone dot planes with examples of halftone dots. The first step in determining values for the halftone memory is to grow each of the 265 halftone dots. The dots can be grown utilizing an algorithm that takes into account the TRC (Tonal Reproduction Curve) and shape of the dots. As can be seen halftone dot 261 is essentially circular and represents a certain density. As the densities increase, the halftone dots grow as shown in Fig. 31. Each edge in each of the 256 halftone dot planes is rendered by assigning an intensity value to the memory locations. If the edge to be rendered is primarily perpendicular to the fastscan direction, timing is used to render the edge, and the rendering algorithm will utilize an on-to-off or off-to-on transition that has no intermediate gray values to achieve the steepest slope in exposure possible. If the edge to be rendered is primarily parallel to the slowscan direction, gray will be used to achieve subscan precision of the edge, and the appropriate gray value will be assigned to that memory location. The rendering algorithm must also take into account the slowscan width of the spot (which sets the linearity of the intensity to edge placement position). As can be seen in Fig. 10, and Figs. 11 through 26, the fastscan is using timing to render and the slowscan is using gray to render. As previously mentioned, these intensity values go directly to a D to A converter to be written by the laser diodes.

Curry suggest that one way of rendering the halftone dot is to grow Gaussians of the shape of the spot at every possible position for the laser spot in the immediate past and future with respect to a memory location. The Gaussians could be grown such that in the center of the halftone dot they would be full on and outside the halftone dot they would be full off (for

a write black system, for instance), and at the edge of the halftone dot they would be grown just enough to move the exposure edge to coincide with the boundary of the dot being rendered. Once that is done, the level needed for that particular memory location can be written.

By applying different angles of rotation, various forms of encoded data can be embedded into the halftone structure. In practice, data used to determine the halftone dot rotation angle must accompany the image data. Fig. 35 shows a complex plane with horizontal Real and vertical Imaginary axis and a point a+ib subtending an angle θ_o and having a radius vector r_o. By inspection, $a=r_o \cos \theta_o$, and $b=r_o \sin \theta_o$. Let $r_o = 1$ so that the point is on the unit circle, therefore $a=\cos \theta_o$, and $b=\sin \theta_o$.

Let x+iy be a second point anyplace in the complex plane, so that it subtends an angle θ with a radius r. The object is to find the point x'+iy' after rotating the point x+iy by θ_o around the origin. This is done by observing that x+iy may be represented by $r\ e^{i\theta}$, and a+ib can be represented by $e^{i\theta o}$, so that the rotated point is represented by $r\ e^{i(\theta o.+\ \theta)}$.

So x'=ax-by, and y'=ay+bx, and the new point will be rotated a total of $\theta o.+\ \theta$, and will have the same radius, r, as before. Therefore, the purpose of the hardware to implement this transformation would be to provide a transformed x address (x') into a memory by implementing the equation x'=ax-by. In a similar manner, the hardware would also provide a transformed y address (y') into a memory by implementing the equation y'-ay+bx.

The variables, $a=\sin \theta$ and $b=\cos \theta$, can be continuously varied by an outside process to vary the dot rotation angle. However, this process must be synchronized with the halftone dot rate so that anytime the halftone generator is rendering a particular halftone dot, the same rotation angle is presented to the generator for the entire rendering process for that dot.

The final Office Action states that a shape of a spot is disclosed at column 27, lines 43-54. However, as described above, Curry only suggests that a halftone spot within a halftone cell may be an ellipse. Curry fails to provide the equation provided in Appellant's specification and claims. In fact, the standard equation for an ellipse is $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. However, the only suggestion for using $f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$ for the equations of an ellipse is provided by the claims of Appellant, the final Office Action resorts to the use of impermissible hindsight to arrive at Appellant's equation.

Further, Curry fails to disclose an equation for an ellipse that allows for changes in the shape of the spots in an asymmetric manner (i.e., non-separable in x-y) to reduce the artifacts. Appellants spot function equation, $f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$, is specifically chosen for the properties of being non-separable in x-y.

In addition, because Curry fails to suggest the claimed spot function equation, Curry fails to suggest scaling a first spot function ordinate. Because Curry fails to suggest the claimed spot function equation, Curry fails to suggest scaling a second spot function ordinate. Because Curry fails to suggest the claimed spot function equation, Curry fails to suggest a scaling function that is based on a spot shape parameter for controlling the shape of the spot and the radius of the spot.

Curry does in fact suggests that that one way of rendering the halftone dot is to grow Gaussians of the shape of the spot at every possible position for the laser spot in the immediate past and future with respect to a memory location. However, such teaching is time consuming, requires a large memory for storing Gaussians of the shape of the spot at

every possible position and fails to specifically make use of the spot function recited in the claims.

In view of the above failings of Curry to define a spot function is described by

$f(x,y) = \frac{1}{2}\left(\cos(\pi x / p_x) + \frac{1}{S(p,r)}\cos(\pi y / p_y)\right)$, Appellant respectfully submits that

independent claims 1, 7, 17 and 23 are patentable over Curry.

b. ALLEN FAILS TO OVERCOME THE DEFICIENCIES OF CURRY

The final Office Action admitted that Curry failed to suggest a spot function described

by $f(x,y) = \frac{1}{2}\left(\cos(\pi x / p_x) + \frac{1}{S(p,r)}\cos(\pi y / p_y)\right)$, where x and y are the first and second spot

function ordinates, p_x scales ordinate x, p_y scales ordinate y, p is a spot shape parameter for controlling the shape of the spot, S(p,r) is a scaling function, and r is the radius of the spot.

The final Office Action stated that Allen discloses the above spot function. The final Office Action refers to column 4, lines 16-23 of Allen. However, a full reading of Allen reveals that Allen merely describes a visual sensor that is able to detect the state of one or more imaging parameters such as spot size and shape and spot ellipticity.

However, disclosing a visual sensor that is able to detect a spot shape, for example, has nothing to do with defining a spot function , scaling the spot function and printing using the scaled spot function. Rather, Allen is merely concerned with detecting image parameters – not how to define a spot function. As stated above, Allen fails to disclose, teach or suggest anything having to do with scaling a spot function or the halftoning manipulation itself. More specifically, Allen fails to suggest defining a spot function that is described by

$f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$. Allen does not suggest scaling the above-defined spot function. Allen does not suggest printing using the scaled spot function.

Rather, Allen is merely concerned with the calibration of various imaging parameters of an output device. Allen provides a visual sensor that detects different imaging parameters that are useful for calibrating or verifying the quality of the output device. Allen only mentions spot size, shape and ellipticity as parameters that may be detected by the visual sensor.

Accordingly, Allen fails to disclose, teach or suggest defining a spot function described by $f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$, scaling the defined spot function and printing using the scaled spot function.

Accordingly, Appellant respectfully submits that Curry and Allen, alone or in combination, fail to disclose, teach or suggest independent claims 1, 7, 17 and 23.

c. VASWANI AND CUNNIFF FAIL TO OVERCOME THE DEFICIENCIES OF CURRY AND ALLEN

Vaswani and Cunniff are silent regarding defining a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell, scaling the spot function according to grayscale levels using a parameterized spot radius scaling function that varies according to a value of a first and second spot function ordinate and an asymmetric shape changing scaling function based on a gray level for the spot and printing using the scaled spot function, wherein the spot function is described by:

$$f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y, p is a spot shape parameter for controlling the shape of the spot, S(p,r) is a scaling function, and r is the radius of the spot.

Rather, Vaswani is merely cited as disclosing a hardware card for graphics processing disposed between a control unit and an image output device. Similarly, Cunniff is merely cited as disclosing a graphics hardware card disposed within a control unit.

Accordingly, Curry, Allen, Vaswani And Cunniff, alone or in combination, fail to disclose, teach or suggest each and every limitation recited in independent claims 1, 7, 17, and 23.

2. DEPENDENT CLAIMS 5, 11 AND 21 ARE PATENTABLE OVER CURRY IN VIEW OF ALLEN, VASWANI AND CUNNIFF

a. CURRY AND ALLEN, ALONE OR IN COMBINATION, FAIL TO DISCLOSE, TEACH OR SUGGEST THE SCALING FUNCTIN RECITED IN DEPENDENT CLAIMS 5, 11 AND 21

Dependent claims 5, 11 and 21 recite that the scaling function, S(p,r), is described by

$$S(p,r) = 1 + \frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{\left(r/\sqrt{2}-1/2\right)^2}{2p^2}\right)$$, where p_m sets a maximum ellipticity of the spot.

Curry fails to describe such a scaling function. Curry suggests that that one way of rendering the halftone dot is to grow Gaussians of the shape of the spot at every possible position for the laser spot in the immediate past and future with respect to a memory location. However, Curry does not suggest that such Gaussians include a parameter, p_m, that sets a maximum ellipticity of the spot. Rather, the well-known probability distribution formula for a normal

distribution uses a standard deviation parameter rather than p_m, which sets a maximum ellipticity of the spot.

Moreover, Curry fails to suggest a scaling function that is offset by 1, as recited in dependent claims 5, 11 and 21. The Office Action states that the offset of +1 would set a specific rotation as shown in Figs. 38-41 of Curry. However, the only suggest for a scaling function, S(p,r) described by $1+\frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{(r/\sqrt{2}-1/2)^2}{2p^2}\right)$ is provided by the teaching of Appellant's specification and claims. The Office Action states that Allen suggest scaling the spot function using the scaling function S(p,r), where p is a spot shape parameter for controlling the shape of the spot and r is the radius of the spot. However, as described above, Allen is merely concerned with the calibration of various imaging parameters of an output device. Allen provides a visual sensor that detects different imaging parameters that are useful for calibrating or verifying the quality of the output device. Allen only mentions spot size, shape and ellipticity as parameters that may be detected by the visual sensor.

Thus, the only suggest for a scaling function, S(p,r) described by $1+\frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{(r/\sqrt{2}-1/2)^2}{2p^2}\right)$ is provided by the teaching of Appellant's specification and claims.

The final Office Action states that the scaling function recited in dependent claims is merely the result of obvious design choices. However, neither Curry nor Allen suggest a scaling function as claimed. Furthermore, Curry and Allen fail to suggest the scaling of a spot function using an offset of =1 and a parameter, p_m, that sets a maximum ellipticity of the spot. The final Office Action merely states that because Curry shows ellipses rotated, it

would have been obvious to provide a scaling function based on a Gaussian function that is modified to include a parameter, p_m, that sets a maximum ellipticity of the spot.

However, Appellant respectfully submits that the mere fact that ellipses may be rotated or that the formula for a Gaussian function is known, providing a scaling function as described by $1+\frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{\left(r/\sqrt{2}-1/2\right)^2}{2p^2}\right)$ may only be arrived at through a reading of Curry and Allen only by the use of impermissible hindsight. Curry and Allen fail to even mention the scaling of a spot function using an offset of =1 and a parameter, p_m, that sets a maximum ellipticity of the spot.

Accordingly, Appellant respectfully submits that claims 5, 11 and 21 are patentable over Curry and Allen.

c. VASWANI AND CUNNIFF FAIL TO OVERCOME THE DEFICIENCIES OF CURRY

Vaswani and Cunniff are silent regarding the use of a scaling function for scaling the spot function, wherein the scaling function is described by $1+\frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{\left(r/\sqrt{2}-1/2\right)^2}{2p^2}\right)$.

Rather, Vaswani is merely cited as disclosing a hardware card for graphics processing disposed between a control unit and an image output device. Similarly, Cunniff is merely cited as disclosing a graphics hardware card disposed within a control unit.

Accordingly, Curry, Allen, Vaswani And Cunniff, alone or in combination, fail to disclose, teach or suggest the use of a scaling function for scaling the spot function, wherein the scaling function is described by $1+\frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{\left(r/\sqrt{2}-1/2\right)^2}{2p^2}\right)$.

Therefore, Appellant respectfully submits that claims 5, 11 and 21 are patentable over Curry, Allen, Vaswani and Cunniff.

C. Conclusion

In view of the above, Appellant submits that the rejections are improper, the claimed invention is patentable, and that the rejections of claims 1-2, 5, 7, 8, 11, 13, 14, 17-18, 21 and 23 should be reversed. Appellants respectfully request reversal of the rejections as applied to the appealed claims and allowance of the entire application.

Respectfully submitted,

Chambliss, Bahner and Stophel
1000 Tallan Building
Two Union Square
Chattanooga, TN 37402
423-757-0264

By: David W. Lynch

Name: David W. Lynch
Reg. No.: 36,204

VIII. Claims Appendix

1. (Previously Presented) A method for generating a spot for use in halftoning, comprising:

defining a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell;

scaling the spot function according to grayscale levels using a parameterized spot radius scaling function that varies according to a value of a first and second spot function ordinate and an asymmetric shape changing scaling function based on a gray level for the spot, and

printing using the scaled spot function;

wherein the spot function is described by:

$$f(x,y) = \frac{1}{2}\left(\cos(\pi x / p_x) + \frac{1}{S(p,r)}\cos(\pi y / p_y)\right)$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y, p is a spot shape parameter for controlling the shape of the spot, S(p,r) is a scaling function, and r is the radius of the spot.

2. (Previously Presented) The method of claim 1, wherein the two functions allow non-separable changes in spot shape.

3. (Canceled)

4. (Canceled)

5. (Previously Presented) The method of claim 1, wherein the scaling function, S(p,r), is described by:

$$S(p,r) = 1 + \frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{\left(r/\sqrt{2}-1/2\right)^2}{2p^2}\right),$$

where p_m sets a maximum ellipticity of the spot.

6. (Canceled)

7. (Previously Presented) A printing system, comprising:

a control unit for receiving a print file and processing the print file for printing;

a print head for conveying a print job according to the print file; and

a device for generating a spot for use in halftoning wherein the halftoning reproduces an image defined by the print file using the print head, the device defines a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell and scales the spot function according to grayscale level using a parameterized spot radius scaling function that varies according to a value of a first and second spot function ordinate and an asymmetric shape changing scaling function based on a gray level for the spot,

wherein the spot function used by the device is described by:

$$f(x,y) = \frac{1}{2}\left(\cos(\pi x / p_x) + \frac{1}{S(p,r)}\cos(\pi y / p_y)\right)$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y, p is a spot shape parameter for controlling the shape of the spot, S(p,r) is a scaling function, and r is the radius of the spot.

8. (Previously Presented) The printing system of claim 7, wherein the two functions allow non-separable changes in spot shape.

9. (Canceled)

10. (Canceled)

11. (Previously Presented) The printing system of claim 7, wherein the scaling function, S(p,r), is described by:

$$S(p,r)=1+\frac{1}{p_m\sqrt{2\pi}}\exp\left(-\frac{\left(r/\sqrt{2}-1/2\right)^2}{2p^2}\right),$$

where p_m sets a maximum ellipticity of the spot.

12. (Canceled)

13. (Previously Presented) The printing system of claim 7, wherein the device is a hardware card disposed between the control unit and the print head.

14. (Previously Presented) The printing system of claim 7, wherein the device is a hardware card disposed within the control unit.

15-16. (Canceled)

17. (Previously Presented) A program storage medium readable by a computer, the medium tangibly embodying one or more programs of instructions executable by the computer to perform halftoning an image by:

defining a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell;

scaling the spot function according to grayscale level using a parameterized spot radius scaling function that varies according to a value of a first and second spot function ordinate and an asymmetric shape changing scaling function based on a gray level for the spot, and

printing using the scaled spot function;

wherein the spot function is described by:

$$f(x,y)=\frac{1}{2}\left(\cos(\pi x/p_x)+\frac{1}{S(p,r)}\cos(\pi y/p_y)\right)$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y, p is a spot shape parameter for controlling the shape of the spot, S(p,r) is a scaling function, and r is the radius of the spot.

18. (Previously Presented) The program storage medium of claim 17, wherein the two functions allow non-separable changes in spot shape.

19. (Canceled)

20. (Canceled)

21. (Previously Presented) The program storage medium of claim 17, wherein the scaling function, S(p,r), is described by:

$$S(p,r) = 1 + \frac{1}{p_m \sqrt{2\pi}} \exp\left(-\frac{\left(r/\sqrt{2} - 1/2\right)^2}{2p^2} \right),$$

where p_m sets a maximum ellipticity of the spot.

22. (Canceled)

23. (Previously Presented) A printing system, comprising:

means for receiving a print file and processing the print file for printing;

means for conveying a print job according to the print file; and

means for generating a spot for use in halftoning wherein the halftoning reproduces an image defined by the print file using the print head, the means for generating a spot defines a spot function that combines two functions selected to provide asymmetrically changing of the shape of a spot for use in a halftone cell and scales the spot function according to grayscale level using a parameterized spot radius scaling function that varies according to a value of a first and second spot function ordinate and an asymmetric shape changing scaling function based on a gray level for the spot,

wherein the spot function is described by:

$$f(x,y) = \frac{1}{2}\left(\cos(\pi x / p_x) + \frac{1}{S(p,r)}\cos(\pi y / p_y)\right)$$

where x and y are the first and second spot function ordinates, p_x scales ordinate x, p_y scales ordinate y, p is a spot shape parameter for controlling the shape of the spot, S(p,r) is a scaling function, and r is the radius of the spot.

IX. Evidence Appendix

Appellant is unaware of any evidence submitted in this application pursuant to 37 C.F.R. §§ 1.130, 1.131, and 1.132.